

CLAIMS

1. A method of seed distribution using a mobile seeding apparatus including: a metering system having a moving surface in which the movement assists metering of seed to be distributed; a feed system for providing seed from a seed reservoir to the moving
5 metering system, the feed system providing substantial control of speed and density of seed to be able to effectively interact with the moving surface of the metering system.
2. The method of claim 1 having a feed system which provides seed at substantially
10 stationary relative position between the seed from the feed system and the moving surface of the metering system
3. The method of claim 2 with the metering system having a drum with a series of holes each smaller than the seeds and an internal negative pressure such that rotation of the
15 series of holes and suction of the seeds to the surface of the drum provides a metering of the seed.
4. The method of claim 3 with the feed system having an acceleration means for feeding seed from the feed reservoir to the external surface of the drum means at a speed
20 substantially equal to the speed of moving surface of the drum means.
5. The method of any one of the preceding claims having a delivery means for delivering the metered distribution of seed and having a delivery mechanism which substantially controls the speed and direction of the seed.
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6. The method of claim 5 with the feed system providing seed to the moving surface of the metering system on the same side as the moving surface of the metering system provides the metered seed to the delivery system.

7. A seeding apparatus, for providing metered seed placement, in a continuously moving apparatus in a predetermined, uniformly spaced array, and the seeding apparatus including

- a. a frame integral with or attachable to a vehicle;
- b. a seed distribution metering means for metering the seed to be distributed;
- c. rotation means for rotating metering surface of said metering means on said frame at a required speed;
- d. a vacuum generator for generating a negative pressure and connected with said metering means and operatively communicating with said apertures to provide a vacuum suction through said apertures for attracting seeds to the metering means;
- e. a feeding system for feeding seed to the metering means including an acceleration means for feeding seed at a required amount and speed relative to the speed of the metering surface of the metering means and the speed of the vehicle; and
- f. a release mechanism for countering the hold of the vacuum suction of the seeds on the metering surface;

whereby as the metering means rotates the seeds from the hopper means are held against the apertures by the reduced pressure and are carried on the metering surface of said metering means from said feeding system to the release mechanism whereat the seeds are released.

8. The seeding apparatus of claim 7 including

- a. the seed distribution metering means for metering the seed to be distributed including a drum mounted on the frame with a cylindrical peripheral wall forming the metering surface and having a predetermined arrangement of a plurality of spaced apertures smaller than the size of the seed;
- b. drum rotation means for rotatably mounting said drum means on said frame and for rotating the drum at a required speed;

- c. a vacuum generator for generating a negative pressure and connected with said drum and operatively communicating with said apertures to provide a vacuum suction through the apertures;
- d. receival hopper means mounted on the frame for receiving and holding seed for distribution;
- e. a feeding system for feeding seed from the receival hopper to the metering surface of the drum means for the vacuum suction to hold the seed to the surface of the drum means, the feeding system including an acceleration means for feeding seed at a required amount and speed relative to the speed of the metering surface of the drum and the forward ground speed of the vehicle; and
- f. a release mechanism for countering the hold of the vacuum suction on the seeds;

whereby as the drum rotates the seeds from the hopper means are held against the apertures by the reduced pressure and are carried on the metering surface of said drum means from said hopper means to the release mechanism whereat the seeds are released.

9. The seeding apparatus of claim 8 with the acceleration means for feeding seed from the receival hopper to the external surface of the drum means allows for delivery of the seed at a speed substantially equal to the speed of the rotating metering surface of the drum means.

10. The seeding apparatus of claim 9 with the acceleration means comprising a gravitational system having a gravity accelerator with a flow control valve at an upper position of a substantially vertical acceleration chamber and a flow restriction means at lower position the bottom of the chamber providing seed density and speed control of seeds presented as required at the moving drum surface.

11. The seeding apparatus of claim 8 with the acceleration means of the feeding system including one or more belts frictionally engaging the seed with the belt speed controlled relative to the drum surface speed and the vehicle ground speed.
- 5 12. The seeding apparatus of claim 8 with the acceleration means of the feeding system including speed controlled driven rollers frictionally engaging the seed with the roller speed controlled relative to the drum surface speed.
- 10 13. The seeding apparatus of claim 8 with the acceleration means of the feeding system including a velocity controlled flap that alters aperture to give the required presentation speed
- 15 14. The seeding apparatus of claim 8 with the acceleration means of the feeding system including a combination of gravitational system and mechanical system in which the seeds are first accelerated by gravity and then these moving seeds are presented to one or more moving belt/s which control the speed of the seeds by accelerating them or acting as a braking system to give the required presentation speed at the point of contact with the drum surface.
- 20 15. The seeding apparatus of claim 8 with the acceleration means including an air jet for blowing seed out along a close circumferential or tangential path at a speed substantially equal to the drum surface speed.
- 25 16. The seeding apparatus of claim 8 with the feeding system mounted on the same diametrical side as the release mechanism.
17. The seeding apparatus of claim 8 with the feeding system located at a position aligned at a circumferential spacing to the vertical tangential position.

18. The seeding apparatus of claim 8 with the release mechanism providing a second distinct separate trajectory for the selected metered seeds which is angularly spaced from a first trajectory of the unselected seeds formed by the feeding system.
- 5 19. The seeding apparatus of claim 18 with the release mechanism providing a release before the vertical tangent of the drum means to ensure a diversion of the released seed along the second trajectory away from the first trajectory of the unselected seeds.
- 10 20. The seeding apparatus of claim 18 with the release mechanism providing a release of metered seed beyond the vertical tangent of the drum means by vacuum adhesion thereto to ensure at least a diversion of the released seed along the second trajectory away from the first trajectory of the unselected seeds.
- 15 21. The seeding apparatus of claim 18 with the release mechanism being a mechanical or pneumatic deflection system.
22. The seeding apparatus of claim 18 with the release mechanism including a deflection system which is external of the drum means.
- 20 23. The seeding apparatus of claim 22 with the release mechanism including an airjet external of the drum means.
24. The seeding apparatus of claim 18 with the release mechanism including a deflection system which is operating internally of the drum means.
- 25 25. The seeding apparatus of claim 18 with the release mechanism including roller operating internally of the drum means to cut-off the vacuum adhesion of the seed to the drum surface.
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26. The seeding apparatus of claim 8 with the drum having on its surface or be constructed of material which enhances its ability to accelerate and capture seeds thereon.

5 27. The seeding apparatus of claim 8 with the release mechanism providing a release beyond the vertical tangent of the drum means to ensure a diversion of the released metered seed away from a vertical fall to form a metered seed release trajectory.

10 28. The seeding apparatus of claim 8 having a recycling means for recycling unmetered seed that is not vacuum engaged by the drum, the recycle means having a return chute at an angle to the delivery means such that the seed which is not metered by vacuum engagement with the drum follows an unselected particle trajectory into the return chute.

15 29. The seeding apparatus of claim 20 having a delivery means for delivering the metered released seed and having a delivery mechanism which substantially controls the speed and direction of the seed.

20 30. The seeding apparatus of claim 20 with the feed system providing seed to the moving metering system on the same side as the moving metering system provides the metered seed to the delivery system.

25 31. The seeding apparatus of claim 20 in which the metered seed following a metered seed release trajectory through the delivery system is further controlled by an adjustable venturi system to control an exit speed of seeds.

30 32. The seeding apparatus of claim 20 with the exit velocity of seed from the delivery is controlled such that the exit speed is substantially opposing the velocity of the vehicle on which the seeding apparatus is mounted to provide a relatively stationary deposit of the seeds to the ground.

33. The seeding apparatus of claim 8 including a supporting means in which the drum, the acceleration means and receival hopper are maintained substantially level.

5 34. The seeding apparatus of claim 33 in which the supporting means is a platform having hydraulic rams to provide self levelling of the platform.

35. The seeding apparatus of claim 8 including an electronic sensor at an exit of the delivery tube delivering metered particles to provide one or more of the following uses:

- 10 a. to establish particle exit velocity from delivery tubes providing the ability to control the exit velocity;
- b. to count seeds ejected;
- c. to monitor for tube blockage;
- 15 d. to control seed exit velocity so that seeds can be shot into soil to a predetermined depth.

36. The seeding apparatus of claim 35 including an adjustable venturi communicating with the delivery tube with controls to vary the exit velocity of particles.

20 37. The seeding apparatus of claim 36 including a roller following the outlet of the exit tube to prevent seed bounce.

25 38. A method of seed distribution using a mobile seeding apparatus using a substantially precise vacuum metering and controlled delivery system to provide fast accurate sowing grid patterns with a required speed of sowing and required delivered density of seed, wherein the precise metering system uses an acceleration means to accelerate seed to a speed substantially the same as the speed of a vacuum metering surface having apertures and the delivery system includes control of outputted speed of seed by a venturi flow control in outlet tubes.

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39. A method of seed distribution according to claim 38 which provides predominantly accurate seed placement at ground forward speeds substantially greater than 20 kilometres per hour.
- 5 40. A method of seed distribution according to claim 38 which provides predominantly accurate seed placement at ground forward speeds substantially between 30 and 60 kilometres per hour
- 10 41. A method of seed distribution according to claim 38 allows placement of individual seeds within each row at a selected spacing together with the ability to space multiple rows each at a selected distance apart, both these being variable and easily changed due to the inter-relationship between the aperture spacing within a row on a drum surface, and the spacings between the rows determined by the positioning of the delivery tube exits, and the rotating drum surface speed, and the ratio of the ground
15 forward speed to the drum surface speed, each being independently variable to provide numerous grid options.
- 20 42. A seeding apparatus substantially according to claim 8 where the differing size of the apertures on interchangeable drums allows for a numerous number of seed varieties to be sown with this apparatus.
- 25 43. A seeding apparatus substantially according to claim 7 which provides predominantly accurate seed placement at ground forward speeds substantially greater than 20 kilometres per hour.
44. A seeding apparatus substantially according to claim 7 which provides predominantly accurate seed placement at ground forward speeds substantially between 30 and 60 kilometres per hour.
- 30 45. A method of seed distribution using a mobile seeding apparatus substantially as hereinbefore described with reference to the drawings.

46. A seeding apparatus substantially as hereinbefore described with reference to the drawings.